National Aeronautics and Space Administration

Unmanned Aerial Systems Traffic Management (UTM)

SAFELY ENABLING UAS OPERATIONS IN LOW-ALTITUDE AIRSPACE

NASA

UTM Convention 2015
Moffett Field, CA
Parimal.H.Kopardekar@nasa.gov

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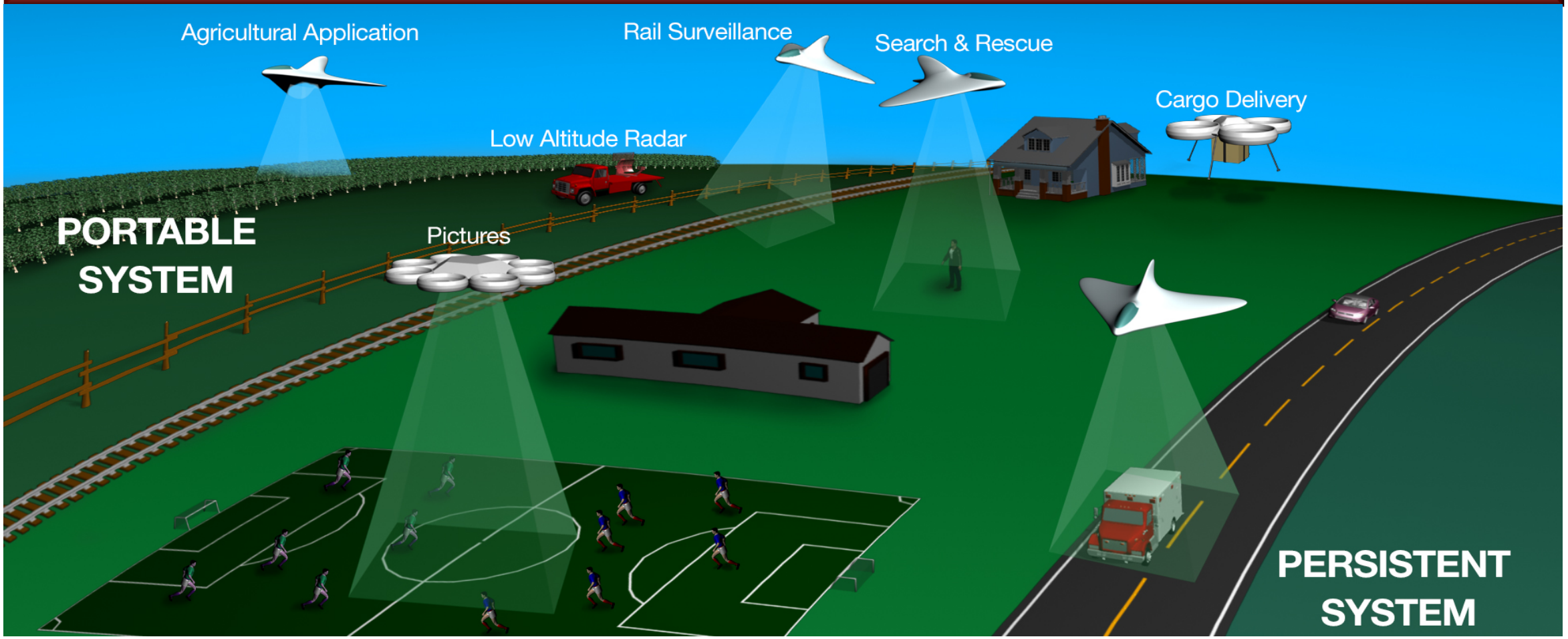
Near-term Goal: Safely enable initial low-altitude UAS as early as possible

Long-term Goal: Accommodate increased demand with highest safety, efficiency, and capacity



UTM: Balancing Multiple Needs

National and Regional Security

Protecting key assets

Safe Airspace Integration

Flexibility where possible and structure where needed

Geographical needs, application, and performance-based airspace operations

Scalable Operations for Economic Growth

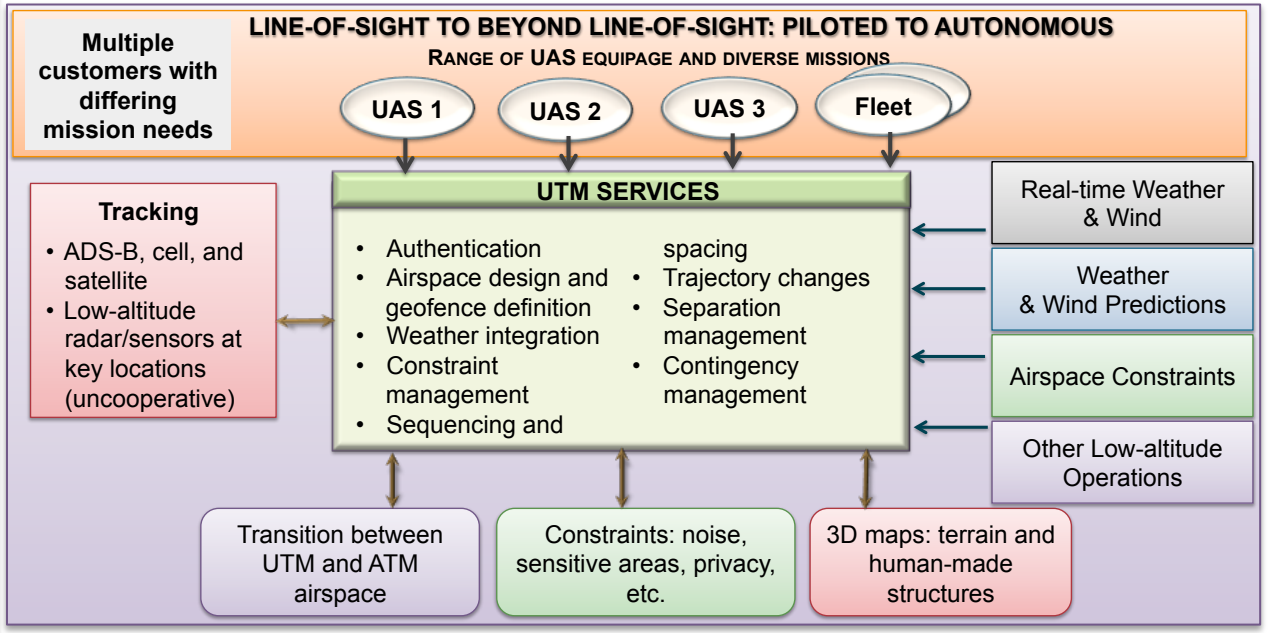
Ever-increasing applications of UAS: Commercial, Agricultural, and Personal

UTM Design Functionality: Cloud-based

Self-driving car does not eliminate lanes and rules for efficient and safe operations

DIGITAL, VIRTUAL, & FLEXIBLE RISK-BASED APPROACH AND SERVICE INFRASTRUCTURE

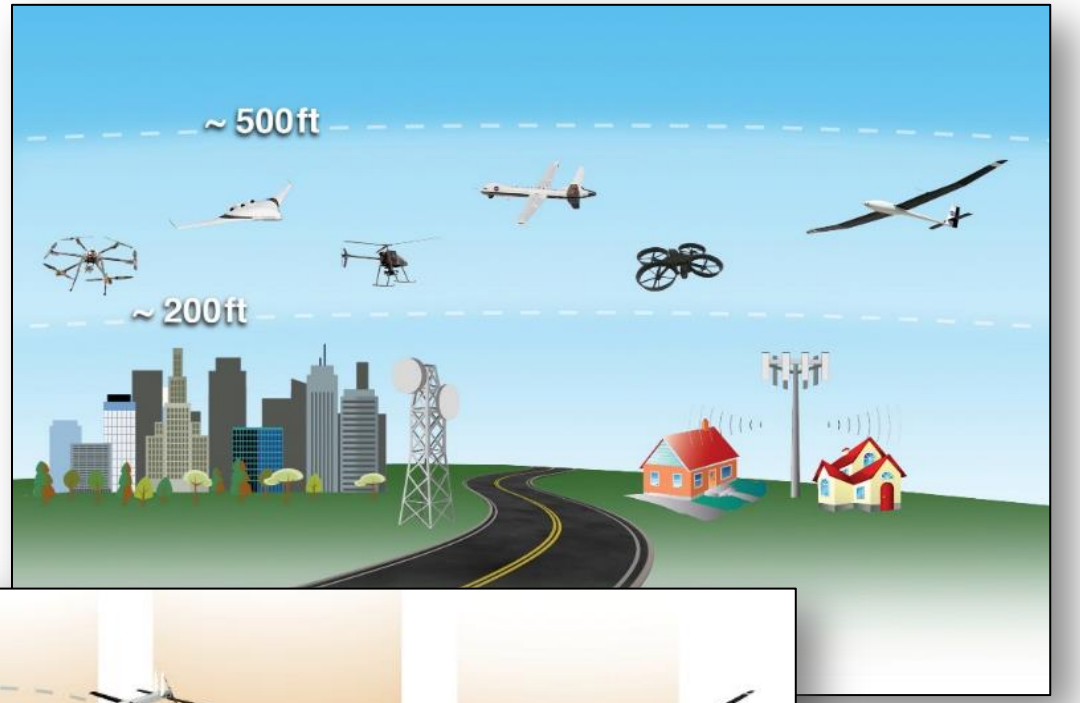
- Safe low-altitude UAS operations with
  - Airspace management and geofencing
  - Weather and severe wind integration
  - Predict and manage congestion
  - Terrain and man-made objects: database and avoidance
  - Maintain safe separation (Airspace reservation, V2V, & V2UTM)
  - Allow only authenticated operations

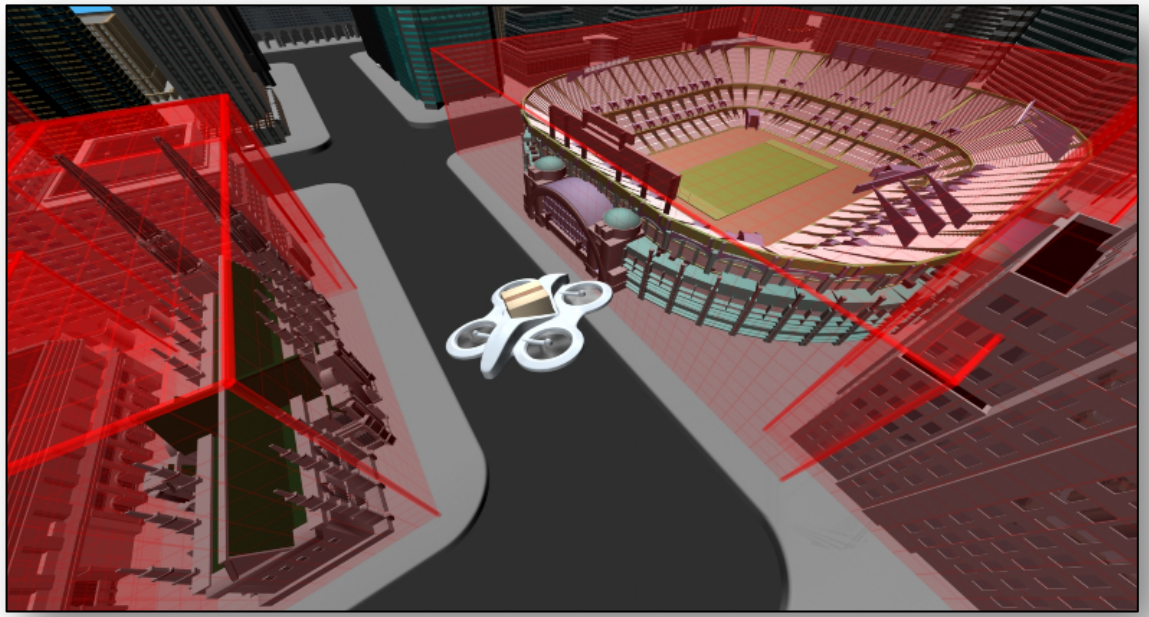


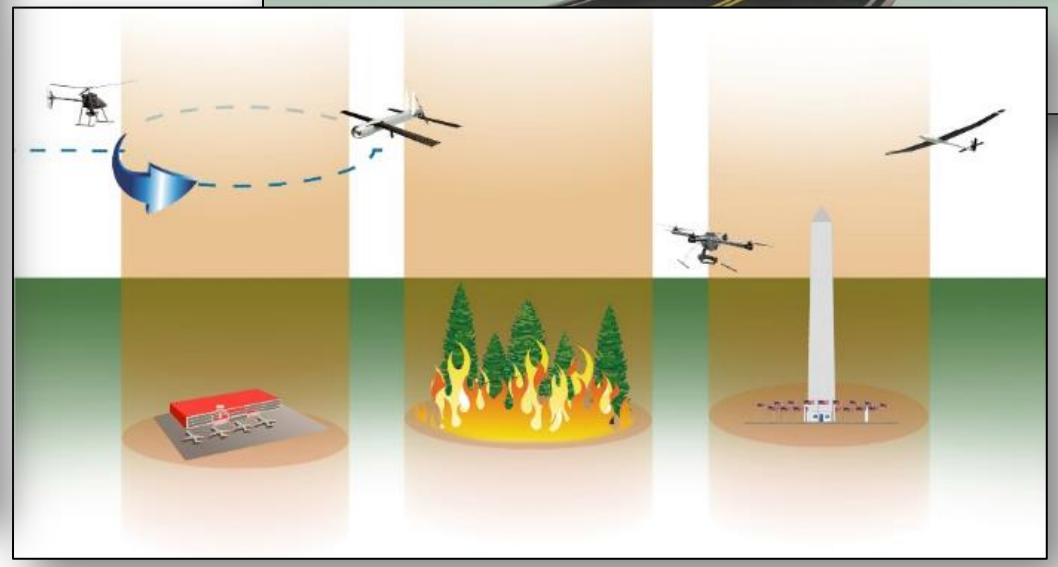
UTM Functions

Airspace Operations & Management

- ~500 ft. and below
- Geographical needs and applications
- Rules of the airspace: performance-based
- Geofences: dynamic and static







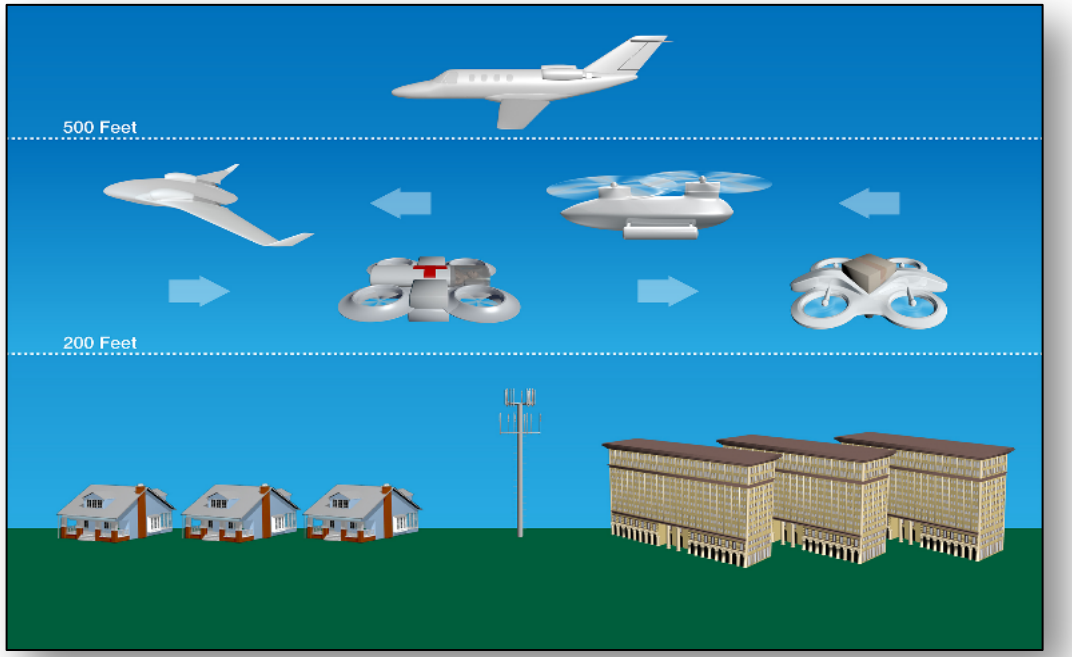
UTM Functions

Wind & Weather Integration

- Actual and predicted winds/weather

Congestion Management

- Demand/capacity imbalance
- Only if needed – corridors, altitude for direction, etc.



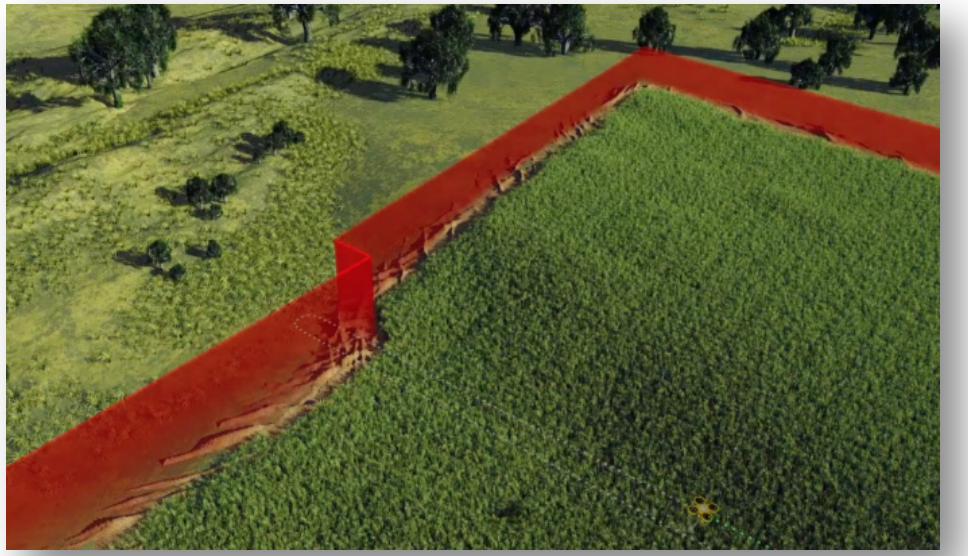
UTM Functions

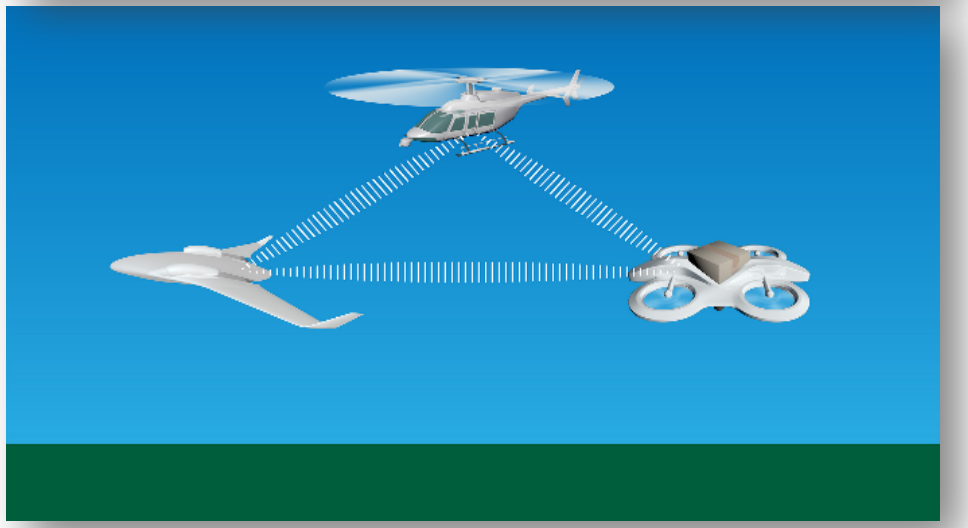
Separation Management

- Airspace reservation
- V2V and V2UTM
- Tracking: ADS-B, cellphone, & satellite based

Contingency Management

- Large-scale GPS or cell outage
- 9-11 like situations





UTM Builds: Each build is independent and deployable

Build 1 (August 2015)

- **Reservation of airspace volume**
- Over unpopulated land or water
- Minimal general aviation traffic in area
- Contingencies handled by UAS pilot
- Enable agriculture, firefighting, infrastructure monitoring

Build 2 (October 2016)

- **Beyond visual line-of-sight**
- Tracking and low density operations
- Sparsely populated areas
- Procedures and “rules-of-the road”
- Longer range applications

Build 3 (January 2018)

- Beyond visual line-of-sight
- Over moderately populated land
- Some interaction with manned aircraft
- **Tracking, V2V, V2UTM and internet connected**
- Public safety, limited package delivery

Build 4 (March 2019)

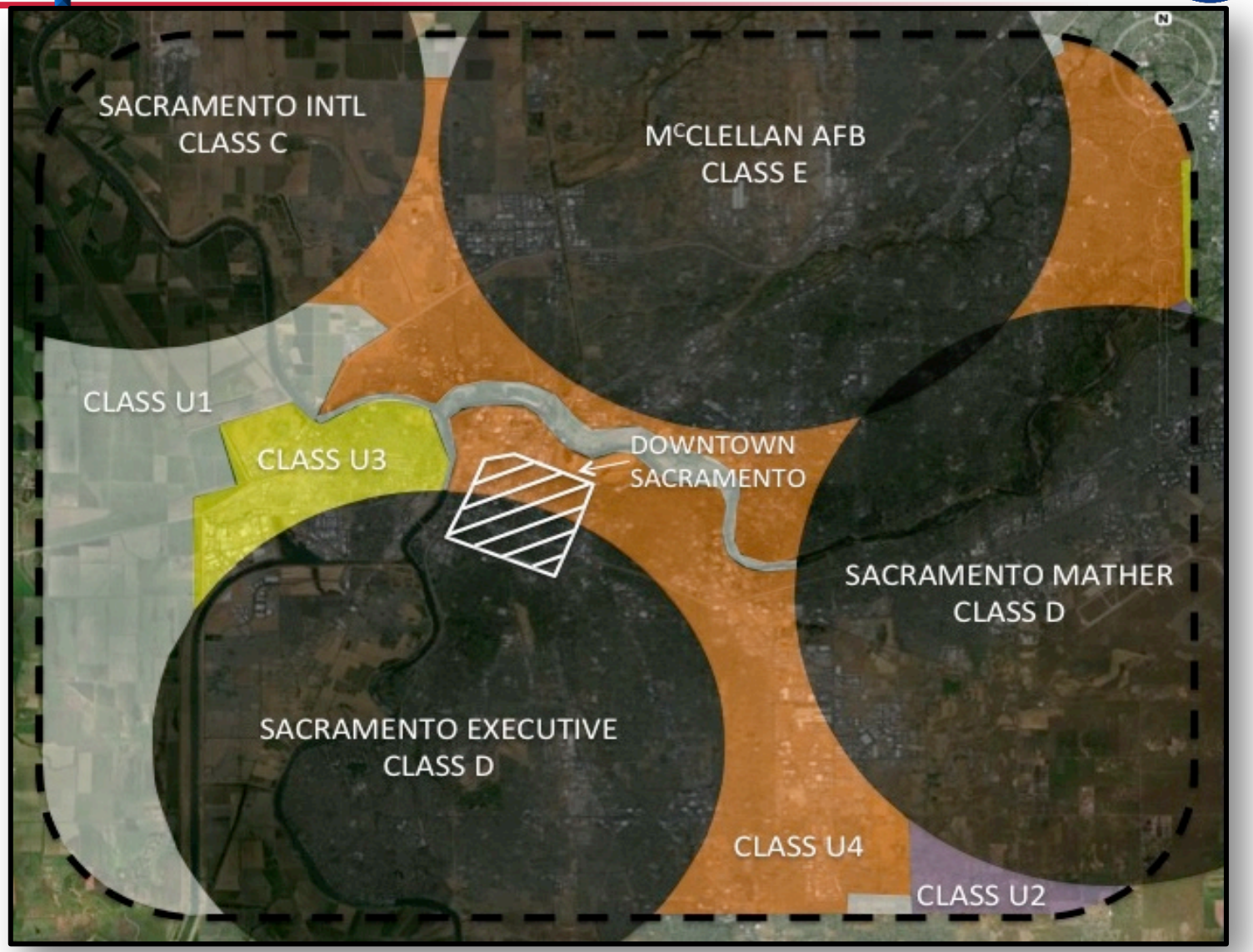
- Beyond visual line-of-sight
- **Urban environments, higher density**
- Autonomous V2V, internet connected
- Large-scale contingencies mitigation
- News gathering, deliveries, personal use

Notional UTM Airspace

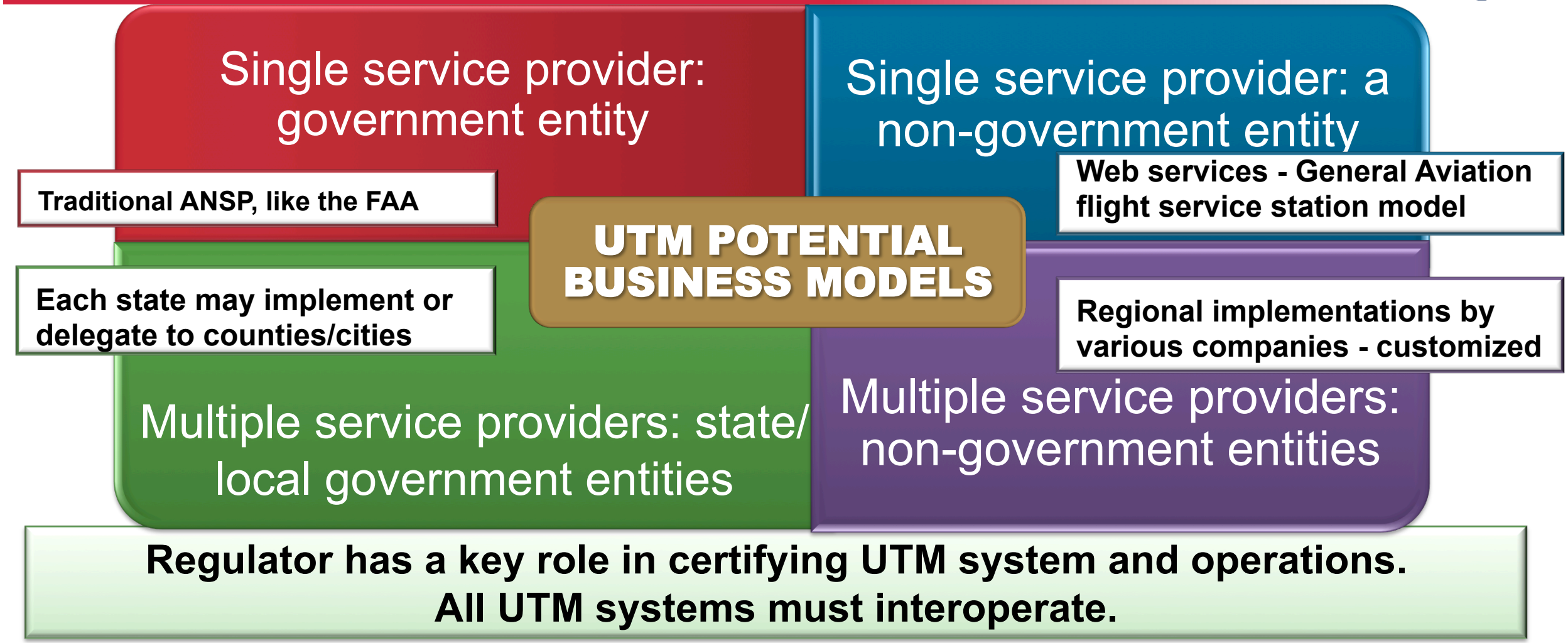
Multiple providers could offer some UTM services

Tailoring operational services based on geographical area needs

Vehicle performance could be different



Consideration of Business Models



Regulator has a key role in certifying UTM system and operations.
All UTM systems must interoperate.

Progress

- Research Transition Team with FAA, DHS, and DoD
- **125+** industry and academia collaborators and increasing
- Initial UTM Concept of Operations: Industry, academia, and government
- Client interface is ready – **You can connect with UTM**
- **Build 1 tests** with 12 partners begin at the end of August
- UTM Demonstration - **Thursday morning 8:30 am**
- Initial UTM system and simulation platform in action – **Exhibit Hall**
- **International interest**

Next Steps

- UTM Build 1 testing in August
- Development, simulations, and testing of UTM Builds 2-4
- Safety analysis

- NASA will continue to work with industry, academia, and government groups
  - Refine operational requirements, system architecture(s), prototype, and conduct tests – Continue until safe airspace integration is proven!

- National initial safe UAS integration campaign: coordinated effort for data collection and demonstrations
  - Through FAA test sites and other approved locations

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Collaborators: 125+ industry and academia members, FAA, DHS, DoD, DOI, and NOAA

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